

**Is it possible to have the similar unit cell in crystals of different form
from the same macromolecule?
(A case study of ribosome crystals)**

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Three different types of ribosome crystals were grown by the vapor diffusion technique in hanging drops as described in (1,2). The ribosome is a large asymmetric RNA-protein complex (2.3 million Da), which is protein synthesis machinery of the cell. In this poster we would like to discuss the features of ribosome crystallization.

Ribosomes were purified from the thermophilic bacteria *Thermus thermophilus* by centrifugation (3). Three types of crystals (needle, flat tetragonal and tetragonal-like pyramid) can be grown from the same solution; furthermore, in the same drop using 10-15% 2-methyl-2,4-pentanediol as a precipitant. The crystals appeared in 5-48 hours. The crystals were stable and can co-exist in solution over long period of time. The kinetics of appearance of different crystal forms was different: first the needle crystals were grown, then the tetragonal, and finally the tetragonal pyramids. Later studies of the process of ribosome crystal growth depending on supersaturation showed that low supersaturation results in the appearance of tetragonal plates or tetragonal-like pyramids. An electron microscopy study, together with computer modeling, has shown that crystals of different forms have a high probability of having the same unit cell parameters. According to these experiments the following conclusion can be drawn: the level of supersaturation of the macromolecule in a crystallizing solution is one of the major factors for forming three-dimensional crystals convenient for X-rays diffraction analysis. From the same macromolecule solution, crystals of different forms can be grown at approximately the same conditions by varying only the concentration of macromolecule in the solution. Ion-macromolecule and water-macromolecule interactions, apparently, play the main role in the formation of the unit cell of the crystals.

REFERENCES

1. Karpova, E.A., I.N. Serdyuk, Yu.S., Tarakhovsky, E.V., Orlova, and V.L. Borovjagin. Crystallization of ribosomes from *Thermus thermophilus*. (1986) Dokl. Acad. Nauk SSSR 289, p.1263-1266.
2. Karpova E.A. Ph.D. thesis: "Isolation, physical-chemical characterization and crystallization of 70S ribosomes from *T.thermophilus*" (1990) Tbilisi University, Tbilisi, Georgia, USSR.
3. Karpova, E.A., and I.N. Serdyuk. Dissociation of *Thermus thermophilus* 70S ribosomes upon a change of magnesium ion concentration, ionic strength and pH of solution. Mol. Biology (USSR) (1985), 19, 1585-1590.

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